

Optimization Methods in Finance

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1 Motivating Examples

1. Portfolio Optimization.
2. The basic minimum risk problem.
3. Optimizing return and risk.
4. Minimum risk for specified return.
5. Maximum return problem

2 Optimization Theory

1. Fundamentals.
2. Features of an optimization problem.
3. Non-linear programming.
4. Constrained and Unconstrained Optimization.

3 Constrained Optimization

1. Problem Formulation.
2. Lagrangian function of the problem.
3. Active and passive constraints.
4. Regular and non-regular points.
5. Karush-Kuhn-Tucker (KKT) conditions.
6. First order necessary conditions.
7. Second order necessary conditions.
8. Second order sufficient conditions.

4 The generalized reduced gradient method

1. Linear Equality Constraints.
2. Non-linear equality Constraints.
3. Linear inequality constraints.

4.1 Sequential Quadratic Programming

1. Quadratic Programs.
2. The idea.
3. Next iteration.

5 Non-smooth Optimization: Subgradient methods

1. Problem Formulation.
2. Subgradients.
3. A property of convex functions.
4. The method of steepest decent for convex functions.
5. Choice of the parameters.